Exercise 3.2 — Mutually exclusive events

Q1 **a)** P(X and Y) = 0

b) P(X or Y) = P(X) + P(Y) = 0.48 + 0.37 = 0.85

c) P(X' and Y') = 1 – P(X or Y) = 1 – 0.85 = 0.15

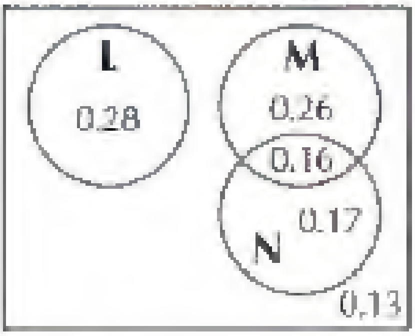
Q2 **a)** P(L or M) = P(L) + P(M) = 0.28 + 0.42 = 0.7

b) P(L or N) = P(L) + P(N) = 0.28 + 0.33 = 0.61

c) P(M or N) = P(M) + P(N) – P(M and N)
= 0.42 + 0.33 – 0.16 = 0.59

d) P(L and M and N) = 0

e) Draw 3 circles to represent events L, M and N, making sure that mutually exclusive events don't overlap. As usual, start the labelling with the middle of the overlapping circles and work outwards.



Q3 **a)** Let B = 'goes bowling', C = 'goes to the cinema', and D = 'goes out for dinner'. All 3 events are mutually exclusive, so:
P(B or C) = P(B) + P(C) = 0.17 + 0.43 = 0.6

b) P(doesn't do B, C or D)
= P(B′ and C′ and D′)
Since either none of B, C and D happen, or at least one of B, C and D happen, "B′ and C′ and D′" and "B or C or D" are complementary events. So:
P(B′ and C′ and D′) = 1 – P(B or C or D)
= 1 – [P(B) + P(C) + P(D)]
= 1 – (0.17 + 0.43 + 0.22) = 1 – 0.82 = 0.18

Q4 **a)** P(A and B) = P(A) + P(B) – P(A or B)
= 0.28 + 0.66 – 0.86 = 0.08
P(A and B) ≠ 0, so A and B aren't mutually exclusive.

b) P(A and C) = P(A) + P(C) – P(A or C)
= 0.28 + 0.49 – 0.77 = 0
P(A and C) = 0, so A and C are mutually exclusive.

c) P(B and C) = P(B) + P(C) – P(B or C)
= 0.66 + 0.49 – 0.92 = 0.23
P(B and C) ≠ 0, so B and C aren't mutually exclusive.

Q5 **a)** You need to show that P(C and D) = 0.
P(C) = 1 – 0.6 = 0.4
P(C and D) = P(C) – P(C and D′) = 0.4 – 0.4 = 0,
so C and D are mutually exclusive.

b) P(C or D) = P(C) + P(D) = 0.4 + 0.25 = 0.65

Q6 Out of the total of 50 biscuits, 30 are plain, and 20 are chocolate-coated. Half of the biscuits are in wrappers, so 25 biscuits are in wrappers. Since there are more biscuits in wrappers than there are chocolate-coated ones, there must be some biscuits (at least 5) which are plain and in wrappers. So events P and W can happen at the same time (i.e. P(P and W) ≠ 0), which means they are not mutually exclusive.